Draw a Fruit Bowl: Rim Ellipse and Fruit Arrangement

Original tasks 1, 2, 3 / complete keys

Task 1

Bowl box W = 8 cm, H = 5 cm, R = 2 cm. Two fruit circles have diameters 3 cm and 2 cm. Their centers are 3 cm apart. Is the spacing valid by the half-sum rule? Show the arithmetic.

Answer: Yes, under this lesson's chosen convention. Half the sum of diameters is (3 + 2) / 2 = 2.5 cm. The center distance is 3 cm, which is greater than 2.5 cm, so the fruit read as separate rather than merged.

Reason: The chosen convention requires center distance at least half the sum of diameters when fruit should read as separate. 3 cm ≥ 2.5 cm, so the placement is valid under that convention.

Check: Recompute (3 + 2) / 2 and compare to 3 cm; both use centimeters.

Task 2

A rim ellipse has major axis 12 cm and minor axis 3 cm. A fruit center is 6.5 cm from the left edge along the major axis and 1.6 cm above the midline. Is the center inside the ellipse? Use the ellipse equation with semi-axes a = 6 cm and b = 1.5 cm.

Answer: No. The ellipse is centered at the box center, so the horizontal offset from the center is 6.5 - 6 = 0.5 cm. The normalized coordinates are 0.5 / 6 = 0.0833 horizontally and 1.6 / 1.5 = 1.0667 vertically. The sum of squares is about 0.0069 + 1.1378 = 1.1447, which is greater than 1, so the point is outside.

Reason: For an ellipse centered at the box center, a point is inside when $(x/a)^2 + (y/b)^2 < 1$, where x is the horizontal distance from the center, not from the left edge. Here the vertical term alone exceeds 1.

Check: Square each normalized coordinate, add, and compare to 1; keep all lengths in centimeters.

Task 3

Three fruit diameters are 4 cm, 3 cm, and 2 cm. The bowl width W is 10 cm. Does the sum of diameters exceed W? If so, by how much?

Answer: The sum is 4 + 3 + 2 = 9 cm. This does not exceed 10 cm; it is 1 cm less than W.

Reason: Add the diameters and compare to W. A sum greater than W suggests crowding; here the sum is smaller, so the fruit can fit with spacing.

Check: Re-add 4 + 3 + 2 and subtract from 10; units are centimeters.

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Original tasks 4 / complete keys

Task 4

A bowl box is W = 9 cm and H = 6 cm. Choose R = 2 cm. A fruit circle of diameter 3 cm has its center 1.5 cm above the midline. Does the fruit outline cross the rim ellipse? Is the placement valid under the center-inside rule? Explain using the vertical semi-axis b = 1 cm.

Answer: The outline crosses the rim, but the placement is not valid under the center-inside rule. The fruit's top reaches 1.5 + 1.5 = 3 cm above the midline, while the rim's top is only 1 cm above the midline. Since 3 cm > 1 cm, the outline extends beyond the rim at the top and crosses the ellipse. However, the center is 1.5 cm above the midline, which is greater than b = 1 cm, so the center lies outside the ellipse. Move the fruit down so its center is within 1 cm of the midline before drawing.

Reason: The rim's vertical semi-axis is R/2 = 1 cm. The fruit's top is center height plus radius: 1.5 + 1.5 = 3 cm. Since 3 cm > 1 cm, the outline crosses the rim. However, the center height 1.5 cm also exceeds b = 1 cm, so the center is outside the ellipse and the placement should be moved down before drawing.

Check: Compare center height plus radius to R/2 to detect a rim crossing, and separately compare center height to R/2 to confirm the center is inside; both in centimeters.

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Source rubric / reflection

- [ ] Rim ellipse uses the stated convention: major axis equals W, minor axis equals R, center on the midline.
- [ ] All fruit centers lie inside the rim ellipse.
- [ ] Fruit outlines cross the rim edge where the fruit would sit, with a clear front-to-back order.
- [ ] Fruit spacing follows the chosen convention of at least half the sum of diameters for separate fruit, or shows intentional overlap with a clear front-to-back order.
- [ ] Arrangement is checkable by measured margins or stated intentional asymmetry.
- [ ] Line style and fruit type may vary; valid alternatives are accepted if the convention and checks hold.

Reflection: What did you check, what did you change, and what will you try next?